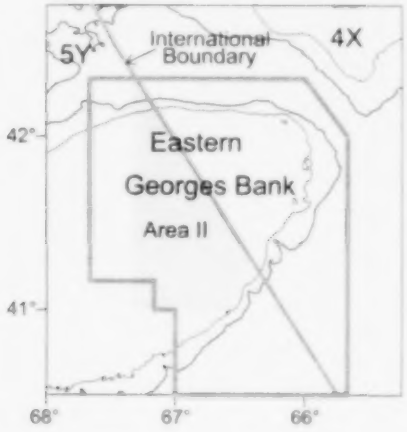
EASTERN GEORGES BANK HADDOCK

[5Zjm; 551,552,561,562]



Summary

- Combined Canada and USA catches in 2007 were 12,680 mt.
- Adult biomass (ages 3+) increased from 9,000 mt in 1993 to 77,100 mt in 2003, declined to 54,000 mt in 2005, and subsequently tripled to a record-high 158,100 mt in 2008.
- The exceptional 2003 year class, estimated at 322.7 million fish at age 1, is the largest in the assessment time series. The 2001, 2002, 2004, 2006 year classes as well as the initial estimate of the 2007 year class are all below the recent 10-year average (18 million fish at age 1, excluding the 2003 year class), while the 2005 year class is above the average.
- From 2003 onwards, the age at full recruitment in the fishery has been at age 5 (rather that age 4 previously) due to a decline in fish size at age. Fully recruited fishing mortality was below $F_{ref} = 0.26$ during 1995 to 2003, above F_{ref} during 2004 to 2006, but declined in 2007 to 0.14.
- With expanded age structure, broad spatial distribution and improved recruitment, current resource productivity is high, hindered only by recent reductions in fish weight at age. However, growth in length remains similar to previous years.
- Assuming a 2008 catch equal to the 23,000 mt total quota, a combined Canada/USA catch of 33,000 mt in 2009 would result in a neutral risk (50%) that the fishing mortality rate in 2009 will exceed $F_{ref} = 0.26$. A catch of 28,000 mt would result in a low risk (25%) that the fishing mortality rate in 2009 will exceed F_{ref}.

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http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html

Canada

July 2008

Catches, Biomass (thousands mt); Recruits (millions)

		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Avg[1]	Min[1]	Max[1]
Canada	Quota	3.9	5.4	7.0	6.7	6.9	9.9	15.4	14.5	12.7	15.0			
	Landed	3.7	5.4	6.8	6.5	6.8	9.7	14.5	12.0	11.9		4.7	0.5	14.5
	Discard	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.2
USA	Quota[6]						5.1	7.6	7.5	6.3	8.1			
	Landed	0.4	0.2	0.6	0.9	1.6	1.8	0.5	0.4	0.2		2.1	0.0	9.1
	Discard[2]	0	0	<0.1	<0.1	0.1	0.2	0.1	0.1	0.5		0.9	0.0	7.6
Total	Quota						15.0	23.0	22.0	19.0	23.0			
	Catch	4.1	5.6	7.5	7.5	8.5	11.8	15.1	12.6	12.7		7.3	2.2	23.3
Adult Biomass[4]		29.2	34.5	47.8	40.8	77.1	71.9	54.0	122.2	152.3	158.1	43.3[3]	4.9[3]	158.1[3]
Age 1 Recruits		27.2	8.9	77.0	3.5	2.6	322.7	6.7	26.9	7.0	13.8	27.5[3]	0.2[3]	322.7[3]
Fishing mortality[5]		0.14	0.16	0.17	0.17	0.20	0.29	0.27	0.28	0.14		0.30	0.13	0.58
Exploitation Rate[5]		12%	13%	15%	14%	16%	23%	22%	22%	12%		23%	11%	40%

[1] 1969 - 2007
[2] discards not estimated in 1999-2000 but assumed negligible
[3] 1931 - 1955, 1969 – 2008
[4] Jan 1 ages 3+
[5] ages 4+ for 1969 - 2007; ages 5+ for 2003 - 2007
[6] for fishing year from May 1 – April 30

Fishery

Under restrictive management measures, **combined Canada/USA catches** declined from 6,522 mt in 1991 to a low of 2,181 mt in 1995, varied between about 3,000 mt and 4,000 mt until 1999, and increased to 15,112 mt in 2005 (Figure 1). Combined catches in 2006 and 2007 were 12,642 mt and 12,680 mt, respectively..

The **Canadian catch** in 2007 decreased slightly to 11,951 mt from 12,051 mt in 2006. The weight of all Canadian landings was monitored at dockside. At-sea observers monitored 83% of the total haddock landed, by weight, in 2007. Discarding and misreporting by the groundfish fishery have been negligible since 1992. Discards of haddock by the Canadian scallop fishery ranged between 29 and 186 mt since 1969 and were 61 mt in 2007.

USA catches in 2007 increased to 729 mt from 591 mt in 2006. Landings were 247 mt and discards were estimated to be 482 mt, primarily from the otter trawl fishery, but discards also occurred in the longline and gillnet fleets.

For the **combined Canada/USA fishery catch in 2007**, the 2003 year class (age 4) and the 2000 year class (age 7) dominated by numbers and weight. Where applicable, discards at age from the USA groundfish fishery and the Canadian scallop fishery were included in the assessment.

Harvest Strategy and Reference Points

The Transboundary Management Guidance Committee has adopted a strategy to maintain a low to neutral risk of exceeding the fishing mortality limit reference, $F_{ref} = 0.26$. When stock conditions are poor, fishing mortality rates should be further reduced to promote rebuilding.

State of Resource

Evaluation of the state of the resource was based on results from an age structured analytical assessment, (Virtual Population Analysis, VPA) that used fishery catch statistics and sampling for size and age composition of the catch for 1969 to 2007 (including discards). The VPA was calibrated to trends in abundance from three bottom trawl survey series; NMFS spring, NMFS fall and DFO. Data to approximate the age composition of the catch during 1931 to 1955 were used to reconstruct a population analysis of eastern Georges Bank haddock suitable for comparison of productivity. Retrospective analyses were conducted to detect any tendency to consistently overestimate or underestimate fishing mortality, biomass and recruitment relative to the terminal year estimates. The current stock assessment does not display a retrospective pattern.

Improved **recruitment** in the 1990s and the strong 2000 year class, lower exploitation, and reduced capture of small fish in the fisheries allowed the **adult population biomass** (ages 3+) to increase from near an historical low of 9,000 mt in 1993 to 77,100 mt in 2003 (Figure 2). Adult biomass decreased to 54,000 mt in 2005 but subsequently increased to 158,100 mt (80% Confidence Interval: 122,300 mt – 201,100 mt) in 2008, higher than the 1931-1955 maximum biomass of about 90,000 mt. The tripling of the biomass after 2005 was due to the exceptional 2003 year class, estimated at 322.7 million age 1 fish, the largest in the assessment time series (1931-1955 and 1969-2007). In contrast, the 2001, 2002, 2004 and 2006 year classes, at less than 8 million each, are below the 18 million average of the 10 most recent year classes (excluding the 2003 year class). The 2005 year class (26.9 million age 1 fish) is well above the 10 year average. The 2007 year class presently appears to be below-average at 13.8 million fish at age 1.

Fishing mortality (population weighted average of fully recruited ages) fluctuated between 0.2 and 0.4 during the 1980s, and markedly increased in 1992 and 1993 to about 0.6, the highest observed. From 2003 onwards, the age at full recruitment in the fishery has been at age 5 (rather than age 4, previously) due to a decline in size at age of haddock. Fishing mortality (ages 4+ for pre-2003 and ages 5+ for 2003 onwards) was below $F_{ref} = 0.26$ during 1995 to 2003, above F_{ref} during 2004 to 2006, but in 2007 declined to 0.14 (80% Confidence Interval: 0.11 – 0.18) (Figure 1). The determination of F_{ref} was based on analyses that assumed full recruitment to the fishery for ages 4 and older.

Productivity

Recruitment, as well as age structure, spatial distribution and fish growth reflect changes in the productive potential. Recruitment, while highly variable, has generally been higher when adult biomass has been above 40,000 mt (Figure 3). The **population age structure** displays a broad representation of age groups, reflecting improving recruitment and lower exploitation since 1995. The **spatial distribution** patterns observed during the most recent bottom trawl surveys were similar to the average patterns over the previous ten years. Consistent with the pattern observed for previous large year classes, the exceptional 2003 year class, the main component of the adult stock, was widely distributed throughout the survey area. Both **length and weight at age** have generally declined since about 2000. While size at age increased in 2008 for the younger age groups, weights remained below the 1986 to 2000 average, except for age 1. The size at age for the 2003 year class is smaller than previous year classes, but its rate of growth at length is similar to previous year classes. DFO survey average weights at length, used to reflect fish **condition,** exhibit a declining trend since the late 1990s. With expanded age structure, broad spatial distribution and improved recruitment, resource productivity is currently high, hindered only by the recent reductions in fish size at age.

Outlook

This outlook is provided in terms of consequences with respect to the harvest reference points for alternative catch quotas in 2009. Uncertainty about standing stock generates uncertainty in forecast results which is expressed here as the risk of exceeding F_{ref}=0.26. The risk calculations assist in evaluating the consequences of alternative catch quotas by providing a general measure of the uncertainties. However, they are dependent on the data and model assumptions and do not include uncertainty due to variations in weight at age, partial recruitment to the fishery, natural mortality, systematic errors in data reporting or the possibility that the model may not reflect stock dynamics closely enough. To characterize the dependence of the projection results on the fishery partial recruitment for the 2003 year class, a sensitivity analysis was done to augment the risk analysis.

For projections, the average survey and fishery weights at age for the three most recent years and the average fishery partial recruitment for the most recent five years were used for inputs. Inputs for the 2003 year class were derived by accounting for recent trends in reduced growth rate. Assuming a 2008 catch equal to the 23,000 mt total quota, a combined Canada/USA catch of 33,000 mt in 2009 results in a neutral risk (50%) that the 2009 fishing mortality rate would exceed $F_{ref} = 0.26$ (Figure 4) and adult biomass is projected to be 131,000 mt at the beginning of 2010. The 2003 year class is expected to constitute 87% of the 2009 catch biomass. A catch of 28,000 mt in 2009 results in a low risk (25%) that the 2009 fishing mortality rate will exceed F_{ref}.

Special Considerations

While best judgment was used to determine the fishery partial recruitments for the reduced weight of the 2003 year class, the risk analysis does not capture the extent of uncertainty of the consequences for various catch levels. Using the observed range of partial recruitment at weight during 1995 to 2007, the 2009 projected catch could vary from 29,000 mt to 36,000 mt. If the realized partial recruitment is near the higher end of

the observed partial recruitment range (and the 2009 TAC is actually achieved), the fishery may possibly forgo available yield; if the realized partial recruitment is at the lower end, the 5+ fishing mortality could be higher than F_{ref}.

The size at age for the 2003 year class is smaller than previous year classes, but, its rate of growth at length is similar to previous year classes. Consequently, current indications suggest that the 2003 cohort could eventually achieve a typical adult size. Size at age 1 of the 2007 year class is similar to year classes before 2000.

Cod and haddock are often caught together in groundfish fisheries, although their catchabilities to the fisheries differ and they are not necessarily caught in proportion to their relative abundance. With current fishing practices and catch ratios, the achievement of rebuilding objectives for cod may constrain the harvesting of haddock. Modifications to fishing gear and practices, with enhanced monitoring, may mitigate these concerns.

Source Documents

TRAC. 2008. O'Brien L, Worcester T, editors. 2008. Proceedings of the Transboundary Resources Assessment Committee (TRAC); 23–25 June 2008. TRAC Proceedings 2008/01.

Van Eeckhaute L, Brooks L, Traver M. 2008. Assessment of haddock on eastern Georges Bank for 2008. TRAC Reference Document 2008/02.

Correct Citation

TRAC. 2008. Eastern Georges Bank Haddock. TRAC Status Report 2008/02.

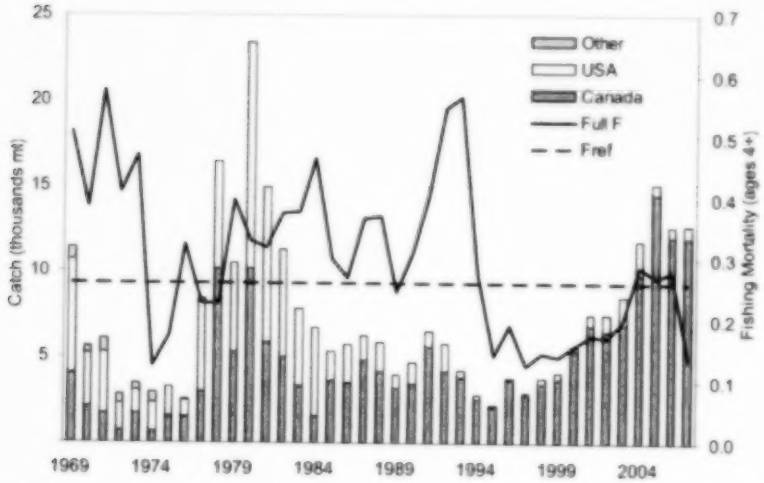

Figure 1. Catches and fishing mortality. (Full F=4+ for 1969-2002 and 5+ for 2003-2007)

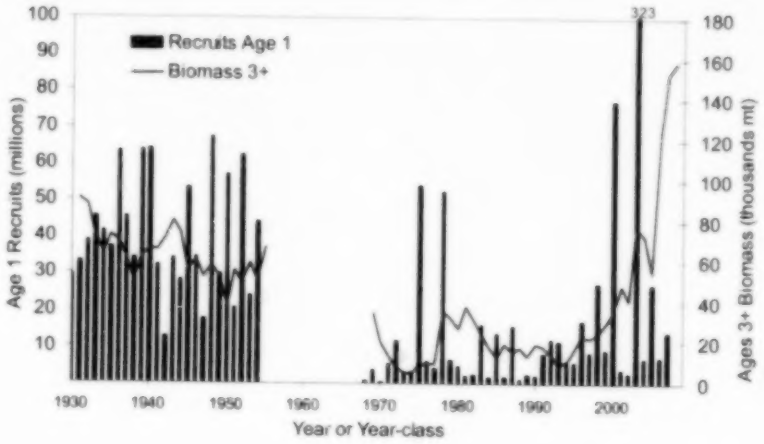

Figure 2. Biomass and recruitment.

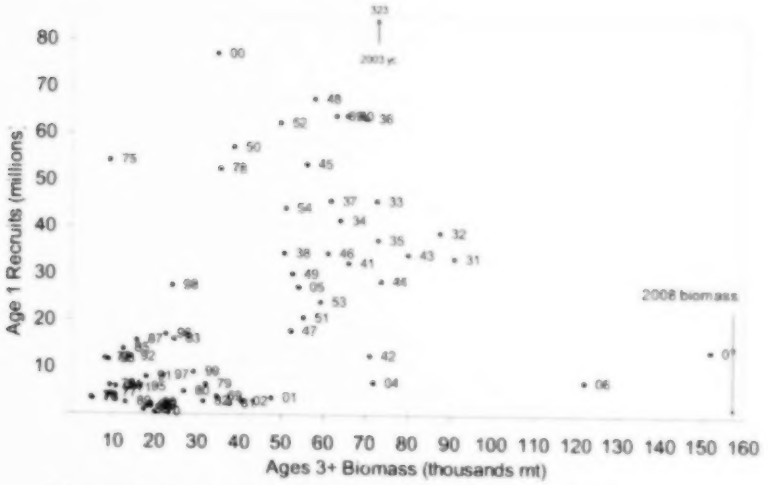

Figure 3. Stock recruitment patterns.

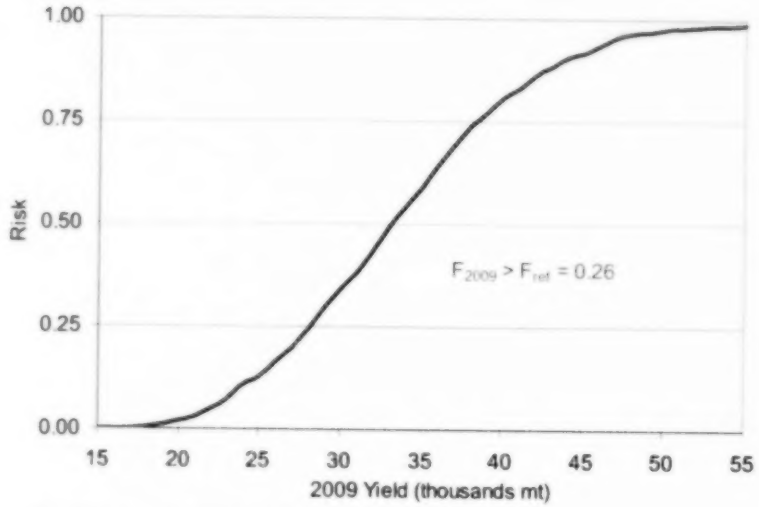

Figure 4. Projection risks.